

# SOLAR GAIN, INC

*Money doesn't grow on trees...it falls from the sky.*

Congresswoman Gabrielle Giffords and Dusenberry-River Library  
presents

Solar Power 101

A Community Education Series on Solar Energy

## The Simplicity of Solar: Solar Thermal and Photovoltaic Basics

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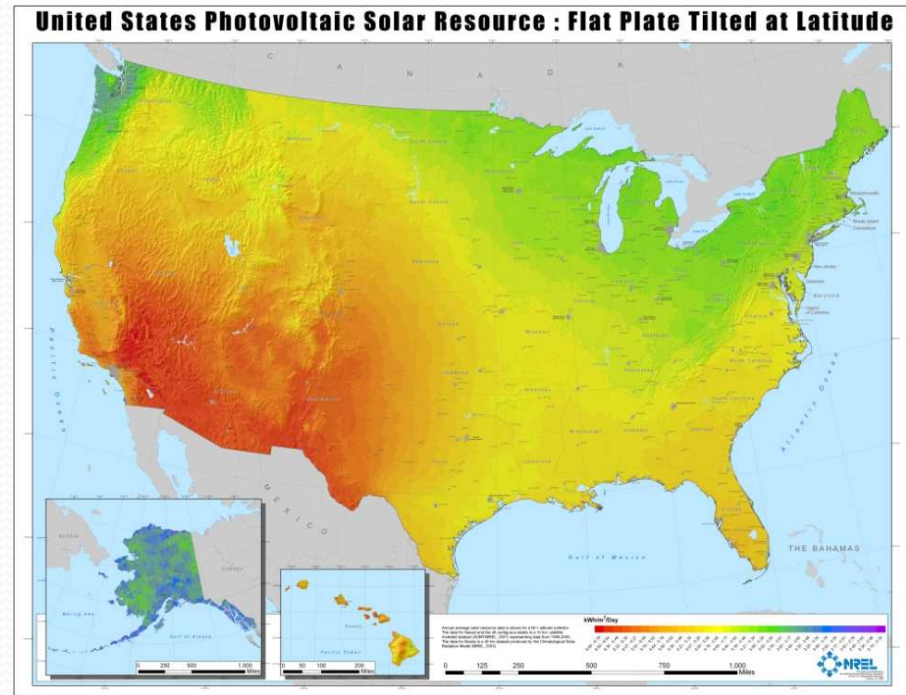


# Solar and Southern Arizona

**Southern Arizona has some of the highest generating potential available in the United States**



**Tucson's Mayor Bob Walkup accepts a Solar America City sign from the US Department of Energy.**





# Before You Go Solar

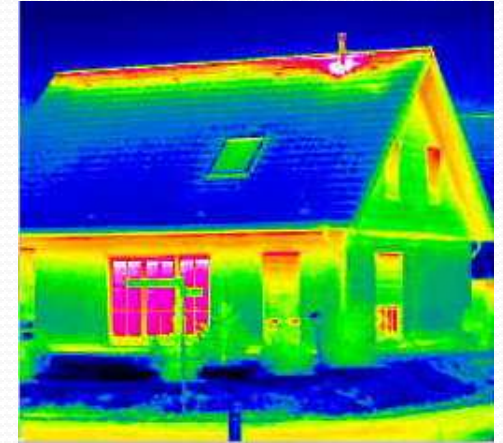
It's more sustainable and cost effective to reduce energy consumption through efficiency.

**Energy Audit**

**Insulation**

**Windows**

**Air-Conditioning**







# Why Go Solar Today ???

- Carbon Footprint
- Appraisal Journal
- 10-30% risk-free, tax-free return on investment.
- Utility Rebates and Tax Credits cover up to 70% of your system's cost.
- TEP rebate is \$3/watt. TRICO was at \$4/watt but recently lowered their rebate not to exceed 40% of the system cost or about \$2.50/watt.



# Starting With Solar Thermal





# Why Start With Solar Hot Water

- It is the most efficient conversion of the sun's energy.
- It has the highest return on investment of all solar technologies, ranging from 15-30% depending on the prior water heating of either electric or gas.
- Has the lowest entry cost, enabling people to enjoy the power of the sun with a small investment.



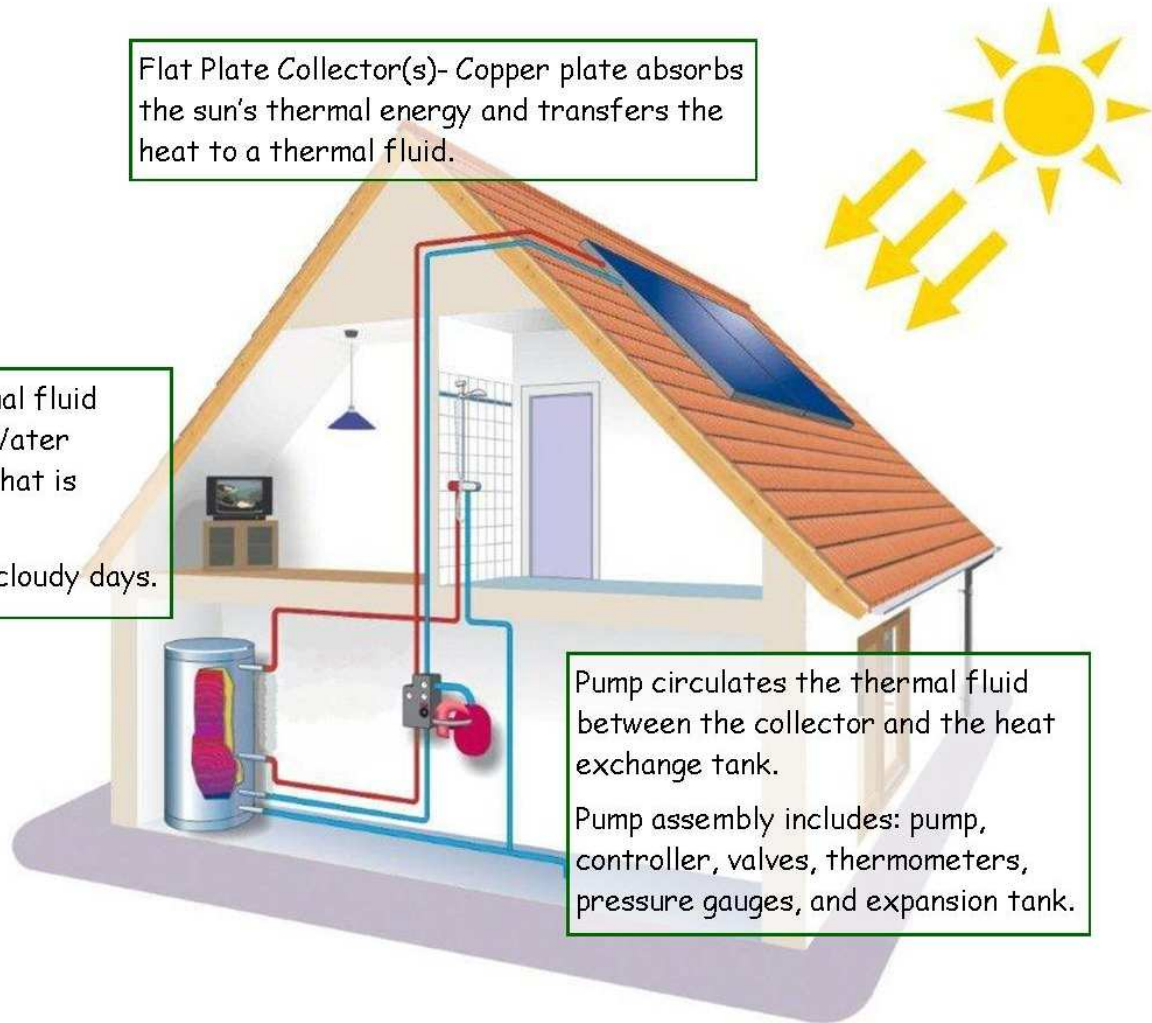
# HOW SOLAR WATER HEATING WORKS

Flat Plate Collector(s)- Copper plate absorbs the sun's thermal energy and transfers the heat to a thermal fluid.

Heat Exchange Water Heater- Thermal fluid transfers heat to an 80 gallon Solar Water Heater through a coil of copper pipe that is integrated with the Water Heater.  
Electric backup assures hot water on cloudy days.

Pump circulates the thermal fluid between the collector and the heat exchange tank.

Pump assembly includes: pump, controller, valves, thermometers, pressure gauges, and expansion tank.





# Passive Solar Thermal

Large copper tubes in collector hold potable water and absorb heat. Has no moving parts.

- Is often used as pre-heater for your water heater.
- Stores water on the roof and weighs over 600lbs when full.
- Can be inefficient in the winter.
- Large volume of water is its freeze protection
- Smallest utility rebate



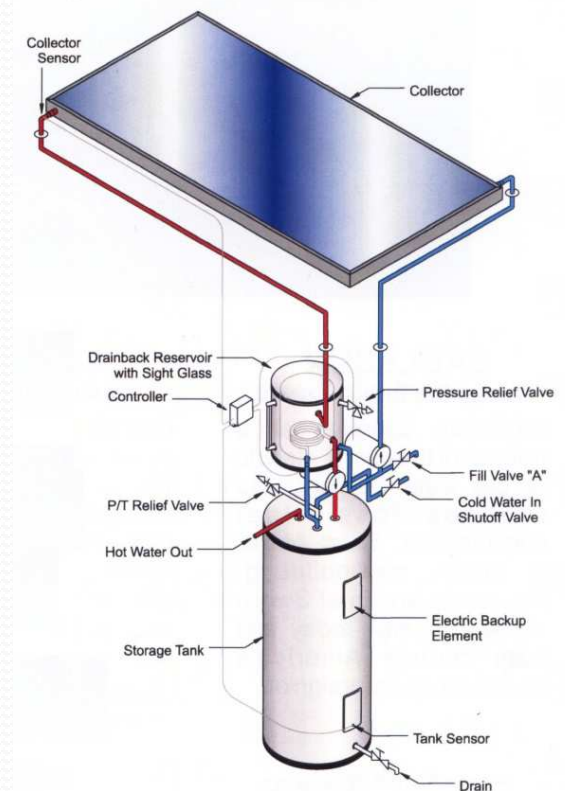




# Drain-Back System

Pumps water to collector on the roof from drain-back tank.

- Uses external heat exchanger.
- Avoids summer stagnation issues.
- Mineral build-up can clog tubes over time.
- Can freeze and rupture if unable to drain.



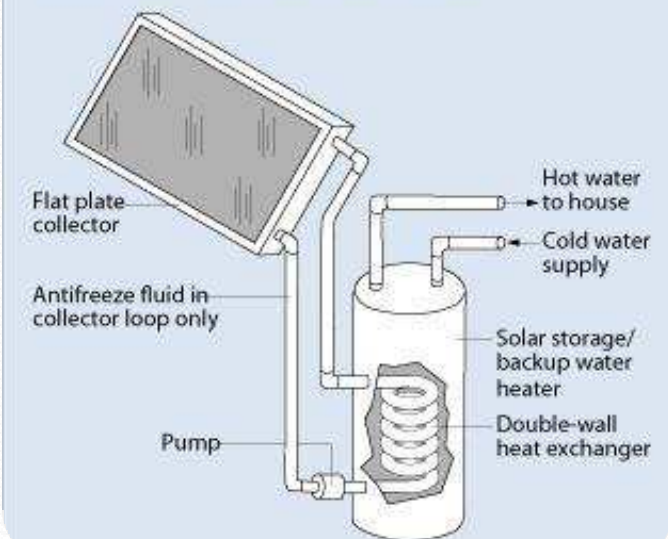


# Active Closed Loop Heat Exchanger

- The glycol acts as this systems freeze protection.
- Efficient system with high rebates
- Can have stagnation in the summer if not enough hot water is used



Active, Closed Loop Solar Water Heater





## Warranties and Maintenance

- Collector warranties range from 10-15 years
- Solar water heater tank warranties range from 6-10 years

Propylene glycol must be flushed and replaced every 3-5 years.



# Utility Rebates and Tax Credits

## TEP Residential Up Front Incentive- Solar Thermal

- \$750 plus ¢ 25/kWh with a maximum of \$1,750

## Tax Credits

- Federal Income Tax Credit- 30% of the system cost after rebates
- State Income Tax Credit- 25% of the system cost-capped at \$1,000





# Your Systems Return on Investment

Buy It	
Total System Cost	\$5,600.00
Utility Rebate	\$1,525.00
30% Federal Tax Credit	\$1,222.50
State Tax Credit	\$1,000.00
Net Cost of Solar Electric System	\$1,852.50

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Rate of Return Analysis		Monthly	Annually
Energy Income	\$35.00	\$420.00	
Tax Free Return On Investment		22.7%	
Cap Rate (Net Income / Purchase Price)		22.7%	
Value with Cap Rate of:	8%	\$5,250.00	
Appreciation / Inflation Rate	1%		
Payback in months with no financing	52.9		
Payback In years	4.4		
Environmental Savings		Monthly	Annually
Energy created in kWhrs	258	3100	
Coal not burned in lbs.	258	3100	
Water saved in gallons	129	1550	
Carbon dioxide avoided in lbs.	516	6192	



## System Cash Flow

\$



Commulative System Performance



# Photovoltaic for your Home









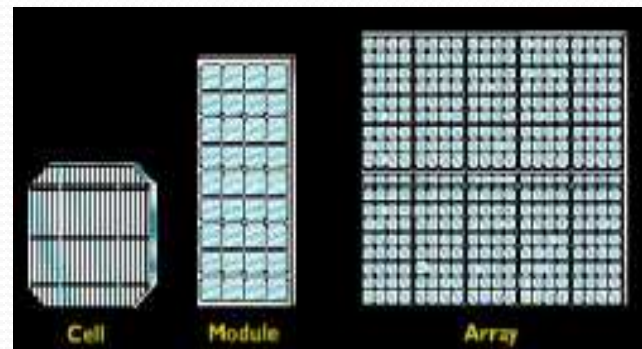
# Solar Panels and How They Work

Individual solar cells are composed of

- layers of silicon
- phosphorous (negative charge)
- boron (positive charge)
- copper conductors to collect the charge created

Your modules are composed of a series of cells.

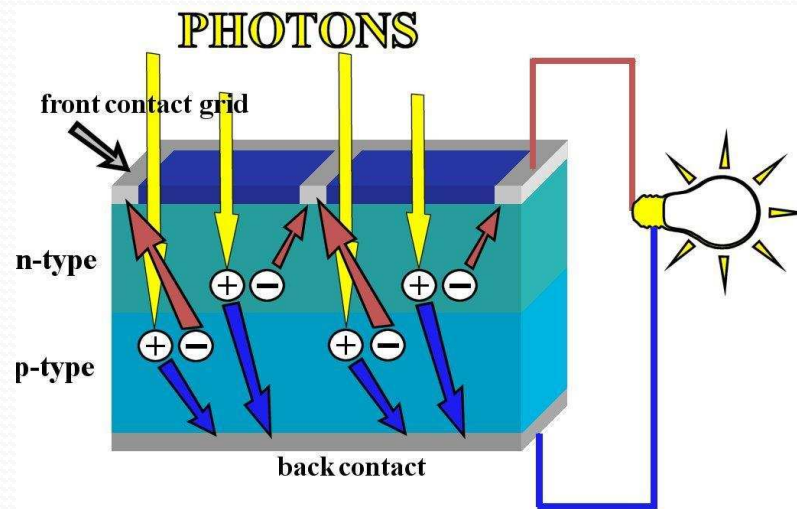
Your solar system or array is composed of a series of solar modules.





# Photovoltaic Process

Through the photovoltaic effect, solar modules absorb photons from the sun, and release electrons in a directional current into copper conductors (DC).

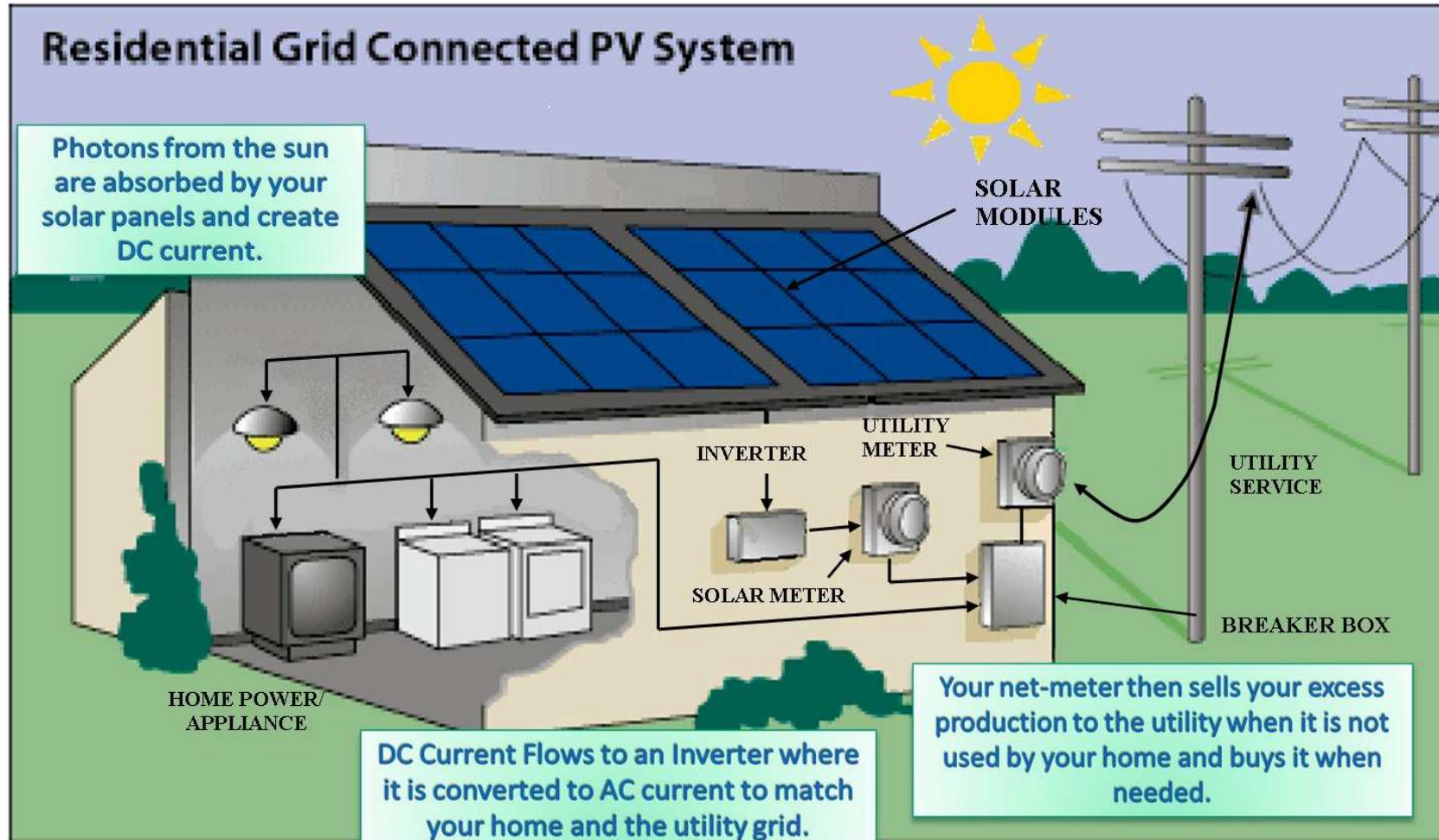




# HOW SOLAR ELECTRIC WORKS

## Residential Grid Connected PV System

Photons from the sun are absorbed by your solar panels and create DC current.



DC Current Flows to an Inverter where it is converted to AC current to match your home and the utility grid.

Your net-meter then sells your excess production to the utility when it is not used by your home and buys it when needed.



# How and Where to Mount Your Solar?





## Roof Mounting

Most common and least expensive .

Flat roofs

Pitched roofs

Flashing roof penetrations





## Ground Mount

Common due to abundant open spaces.

Option for roofs with inadequate space.

Tracking systems used for ground mounts can increase system efficiency but also increase cost.





## Integrated Mounting

Is a more fun and creative way of using your solar modules for added structural benefits such as shading windows or covering a patio area.

Prices depend on the intricacy of design and materials.





# Factors Effecting your Solar System Performance

**Shading**

**High Temperatures**

**Inverter Efficiency**

**Module Tilt Angle and Azimuth**





# Environmental Impacts of a Solar Electric System

For a 5 kW PV System

- Offsets 12,144 pounds of CO<sub>2</sub> annually
- Prevents the burning of 8,906 pounds of coal annually
- Saves 3,238 gallons of water annually
- Is equivalent to planting .70 acres of trees
- Is equivalent to not driving 10,839 miles in your car





# Benefits of Utility Rebates and Tax Credits

## Combination of Tax Credits and Utility Rebates Cover up to 70% of System Costs

### TEP/Unisource Utility Rebate

**Residential-** Up Front Incentive of \$3/watt up to 25kW systems, paid in 6-8 weeks

**Commercial-** Upfront Incentive of \$2.50/watt up to 100kW systems, paid in approx. 8 weeks

**Performance Based Incentive-** Payment of incentive based on performance of your system kW generated annually – contracts of 10 and 20 years @ \$.202/kWh and \$.18/kWh

### Federal Tax Credits

**Commercial and Residential-** Tax Credit of 30% of the system cost after rebates on your Federal Income Taxes- no cap

**5 year Straight Line Depreciation - Commercial Only**

### State Tax Credit

**Residential-** Tax Credit of 25% of the system cost after rebates on your State Income Taxes- Capped at \$1000 and eligible only once a year

**Commercial-** Tax Credit of 10% of the system cost after rebates on your State Income Taxes- Capped at \$25,000 and eligible only once a year

**See DSRIE Website for specifics:** <http://www.dsireusa.org/>



# The Cost of Your Solar System

Photovoltaic Solar Systems are traditionally priced by \$ per watt. Our grid-tie systems typically range from \$5.80 to \$6.30. Prices depend on the size of your system, how it is mounted, and what brand of components are used.

**Average Home's System Size: 5kW, roof-mounted system; \$6.10/watt**

<b>System Cost:</b>	<b>\$30,500</b>
<b>Utility Rebate @ \$3/watt</b>	<b><u>(\$15,000)</u></b>
<b>Customer Out of Pocket</b>	<b>\$15,500</b>
<b>Federal 30% Tax Credit</b>	<b><u>(\$4,650)</u></b>
<b>Arizona State Tax Credit</b>	<b><u>(\$1,000)</u></b>
<b>End of Year 1 Net System Cost</b>	<b>\$9,850</b>

**\*Please check with your personal tax accountant about your eligibility and applications of tax credits.**



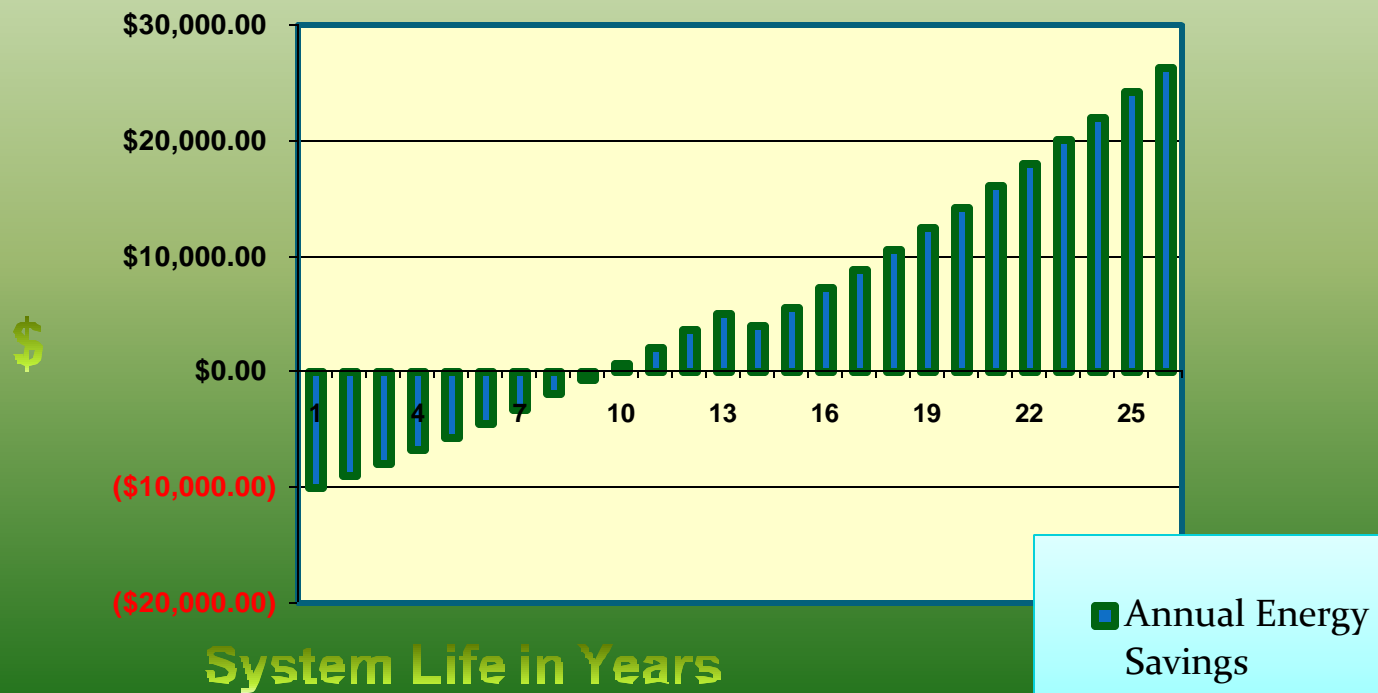
# Your Systems Return on Investment

## Financial Information on a 5kW Solar System

Rate of Return Analysis		Monthly	Annually
<b>Energy Income</b>		<b>\$90.22</b>	<b>\$1,082.61</b>
Debt Service (P & I)		\$0.00	\$0.00
Net Cash Flow		<b>\$90.22</b>	\$1,082.61
<b>Cash ROI (1st Year)</b>			<b>10.7%</b>
Cap Rate (Net Income / Purchase Price)			10.7%
Value with Cap Rate of:		8%	\$13,532.62
Appreciation / Inflation Rate		1%	
Payback in months with no financing		112.6	
<b>Payback in years (does not include inflating energy costs)</b>		<b>9.4</b>	



## PV System Break Even Cash Flow







# Social and Economic Reasons For Solar



Giffords and her new Solar System

## Why Solar is Serious Energy

Solar offers a tremendous opportunity for Arizona, and all of America, to address some of the largest challenges we face:

**Economy & Jobs--** Solar power is an emerging industry with huge global potential. The worldwide market for power is over \$6 trillion a year and growing fast, and everyone is looking for new, clean sources of electricity. Solar means good jobs and a competitive America.

**National Security--** With solar power, the fuel is 100% domestic and free. There are no long supply chains to defend or rogue states to threaten our energy supplies. What's more, we don't have to send our hard-earned dollars overseas.

**Environment--** Solar power is good for the environment. It generates electricity without emitting greenhouse gases, and most solar technologies use little or no water. At the end of its life, the components of solar technologies can be recycled.

**Good for Arizona--** Best of all, solar power is a natural fit with our home state. Arizona has some of the best solar conditions in the world, providing more than enough sun to generate every drop of electricity Arizona needs. In addition, we have wide open spaces, great research universities, and a strong workforce. Solar is one of the greatest opportunities Arizona has ever seen.

**Quoted From US Congresswoman Gabrielle Giffords' Solar Web Page**



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Why Wait???

**Solarize Your World Today!!!**

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